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RED HILL CREEK EXPRESSWAY IMPACT ASSESSMENT

TERRESTRIAL RESOURCES TECHNICAL REPORT

June 29, 1998

Prepared for
The Regional Municipality of Hamilton-Wentworth

by

Dougan & Associates
Ecological Consulting Services

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Preamble

The Red Hill Expressway Impact Assessment presents a particularly difficult dilemma for terrestrial ecologists on the study team, who are all personally committed to the protection of natural ecosystems. Our professional role in any project is to assess development impacts as realistically as possible based on available information, and to identify means and mechanisms to work towards net gains in the quality and functions of resulting natural ecosystems.

The Red Hill Creek valley represents a primary habitat corridor that connects two other primary corridors in the landscape, namely the Niagara Escarpment and Lake Ontario shoreline. The impacts of the approved Expressway on key functions of the valley system will be profound and largely irreversible.

Our approach on this project, from the Watershed Plan to the present study, has been to look for every possible opportunity to offset or compensate for this damage. There are obviously difficult choices and significant costs associated with these proposals, and the recommendations will obviously have to be balanced with other recommended mitigation activities related to noise, air and water quality, visual aesthetics and recreation. If commitments to habitat protection or compensation can be worked out, this project may yet yield important benefits as a training ground to improve the understanding of the dynamics and management of highly urbanized ecosystems.

> *"In the end we will conserve only what we love,*
> *We will love only what we understand, and*
> *We will understand only what we are taught."*
> *Baaba Dioum*

Introduction

This Impact Assessment Technical Report summarizes the approaches utilized to predict the impacts of the North-South Expressway (Project) on terrestrial resources in the affected Study Areas. Existing terrestrial resources were summarized in the Background Inventory - Technical Report (October 20th, 1997). That report:

- summarized existing information for the Escarpment lands, Red Hill Valley and Van Wagner's Ponds Environmentally Sensitive Areas / Provincially Significant Wetland;
- reviewed historic conditions;
- supplemented information from the Biological Inventory of the Red Hill Valley (1995) with new field data;
- characterized constraints represented by communities, habitats and known species of significance in the Red Hill Valley;
- summarized key ecological functions, attributes and linkages;
- provided an overview of existing environmental land use designations for the study area; and
- summarized government policies and regulations affecting terrestrial resources in the valley.

The Background Inventory report provided a list of Key Issues and Constraints affecting terrestrial resources; this is repeated here for convenience in the following bulleted text.

- *The study area has been subjected to dramatic environmental changes since settlement, with extensive clearing for agricultural uses both in the Valley, and in uplands to the limits of Escarpment slopes. Since the late 1950's, farm abandonment has resulted in significant regeneration.*

- *Infrastructure in the Valley (trunk sewer, channel works, road and railway crossings, utility easements) has reduced the sustainability of habitats, biodiversity and ecological functions in the corridor.*

- *The Lake Ontario Shoreline, Van Wagner's Ponds ESA, Red Hill Valley ESA and nearby Felker's Falls Escarpment ESA support important functional and linkage relationships in the Region. Taken together, these terrestrial habitats are provincially and regionally important based on their size, connectivity, physical diversity, and scarcity.*

- *The Red Hill Creek Valley and Niagara Escarpment have been designated as Regional Environmentally Significant Areas, and Regional Earth Science Areas of Natural and Scientific Interest. The Niagara Escarpment is a designated UN World Biosphere Reserve.*

- *Specialized communities include Carolinian floodplain forest and Lake Iroquois Sand scarps. These habitats support vegetation and wildlife species considered rare or vulnerable in Canada, Ontario and the Region.*

- *Wetlands are poorly represented in the study area, concentrated in the lower Valley (Red Hill Marsh) and along the lakeshore (Van Wagner's Ponds PSW).*

- *Physical constraints include steep slopes, erodible soils and sensitive hydrology*

- *Groundwater discharge functions appear to have localized importance, affecting biological resource areas in the vicinity of the Escarpment. Recharge is not significant but may represent localized opportunities within the Valley.*

- *Changes to Creek hydrology due to urbanization and past engineered works have had profound negative and positive effects on terrestrial communities in the Valley. Existing erosion events cannot be sustained without mitigation. Floodplain inundation events appear to be benefiting some communities. Poor water quality may be influencing wildlife habitat for waterfowl and mammals.*

- *Critical thresholds of forest interior habitat availability, community structure, successional status, physical habitat functions, and connectivity of linkages are affecting historic significant wildlife attributes. Altered hydrological conditions (quality and/or quantity) may also be affecting wildlife utilization in riparian habitats and wetlands.*

- *Habitat corridors are relatively intact in Valley. Primary corridors also serve as core conservation areas, and the sustainability of habitat regimes present is not assured due to the existing impact load created by residential, industrial and recreational uses.*

- *Although there has been extensive documentation of Valley resources, new records of attributes are still being discovered, and more detailed examination of areas potentially affected by the expressway will continue this autumn.*

  (Source: Background Inventory – Technical Report (Draft), October 20, 1997)

The Impact Assessment process has included recommendations for minor refinement of the Expressway alignment based on input from terrestrial biologists and other disciplines. These recommendations were summarized in Chapter 4.4 of the Draft Summary Report, Volume 1 (November 1997).

At the time that this report is being assembled (June 1998), most of the preliminary design elements for the roadway and associated works have been established and are reflected in the evaluation. The key sources of net impacts have been identified, measured, and

summarized in this document. The impact assessment methodology was circulated to public agencies and to the Community Stakeholder Committee in late February 1998.

Several elements of the Project, including the Escarpment crossing, and new creek channel alignment, were still under study and refinement at the time of report preparation. Any additional impacts associated with the selected design for these elements of the Project will be addressed in an Addendum to this report.

Mitigation strategies have also been identified as part of this study. These are based on approaches identified in the Red Hill Creek Watershed Study, as well as by the Public and Study Team during the Impact Assessment and Design Process (IADP). These have been refined in consultation with the Landscape Restoration Advisory Group (LRAG), which represents the City as well as local experts in landscape management and habitat restoration. In addition, experts familiar with salvage of biodiversity, and contract growing of plant materials were brought in for consultations in May 1998. The finalized strategies will become part of the Landscape Management Plan for the Project, which is being prepared by Hough Woodland Naylor Dance Leinster.

Study Objectives

The goal of the Impact Assessment, as defined in the Exemption Order (May 1996) is to determine the overall impact of the North-South Expressway (including the proposed major changes at the Escarpment crossing, community access, and Queen Elizabeth Way interchanges) and to select appropriate mitigation strategies.

For the purposes of impact assessment for terrestrial resources, the objectives were as follows:

1. Identify factors, indicators and measures with which to assess the range of anticipated impacts.
2. Provide input to refinement of Preliminary Design to reduce impacts.
3. Assess direct and indirect impacts without mitigation.
4. Identify strategies to mitigate impacts.
5. Summarize net impacts.

Methodology

Existing Conditions

Prior to detailed impact prediction, additional field study of the Project corridor was undertaken by study team biologists in October and November 1997. The purpose of this field work was to a) confirm and refine vegetation community boundaries identified in the Watershed study, b) verify earlier documentation regarding significant features, and c) collect additional data regarding species and habitats. Findings from these field studies, and additional information provided by members of the public were incorporated into the GIS database for use in the Impact Assessment.

Impact Assessment

Study Area Definition

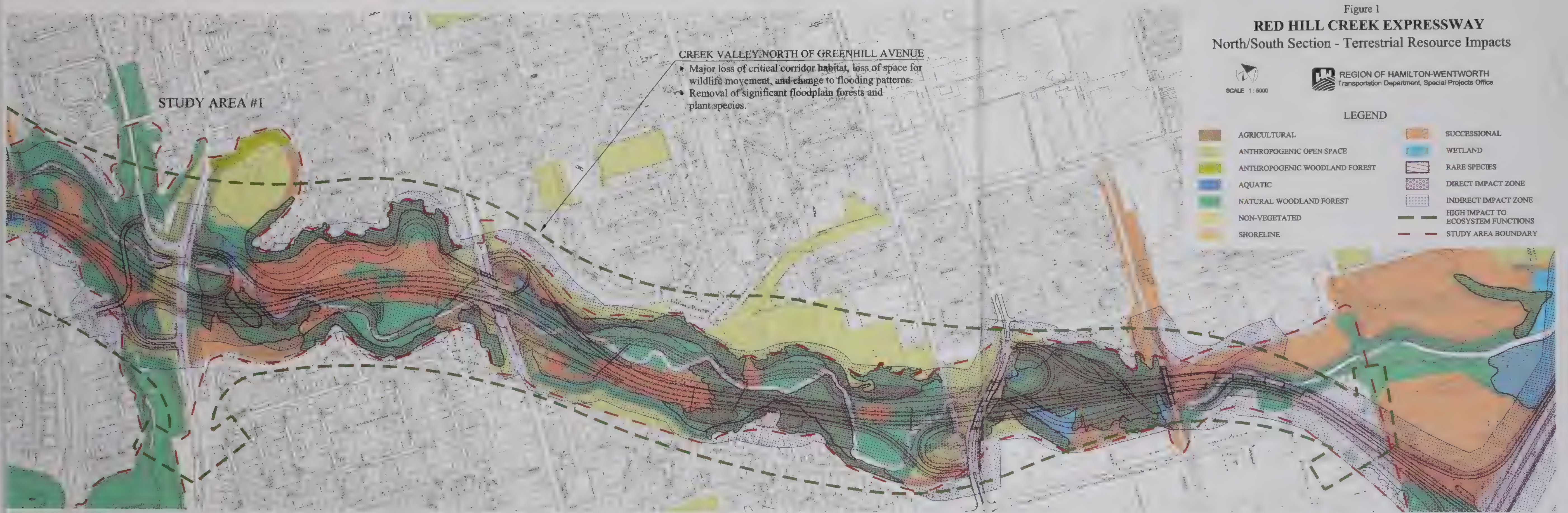
For the purposes of the Impact Assessment for terrestrial resources, the valley and lakeshore areas have been divided into two Study Areas, which are defined below. The precise definition of these boundaries was required to enable GIS analysis of the relative impacts of the Expressway and related works on the environments affected. Obviously, the selection of a larger study area boundary would reduce the proportional representation of impacts. In order to place the impact estimates into perspective, the data analysis also considered the relative area of habitat affected as compared to the total amount of those habitats represented on a Watershed basis.

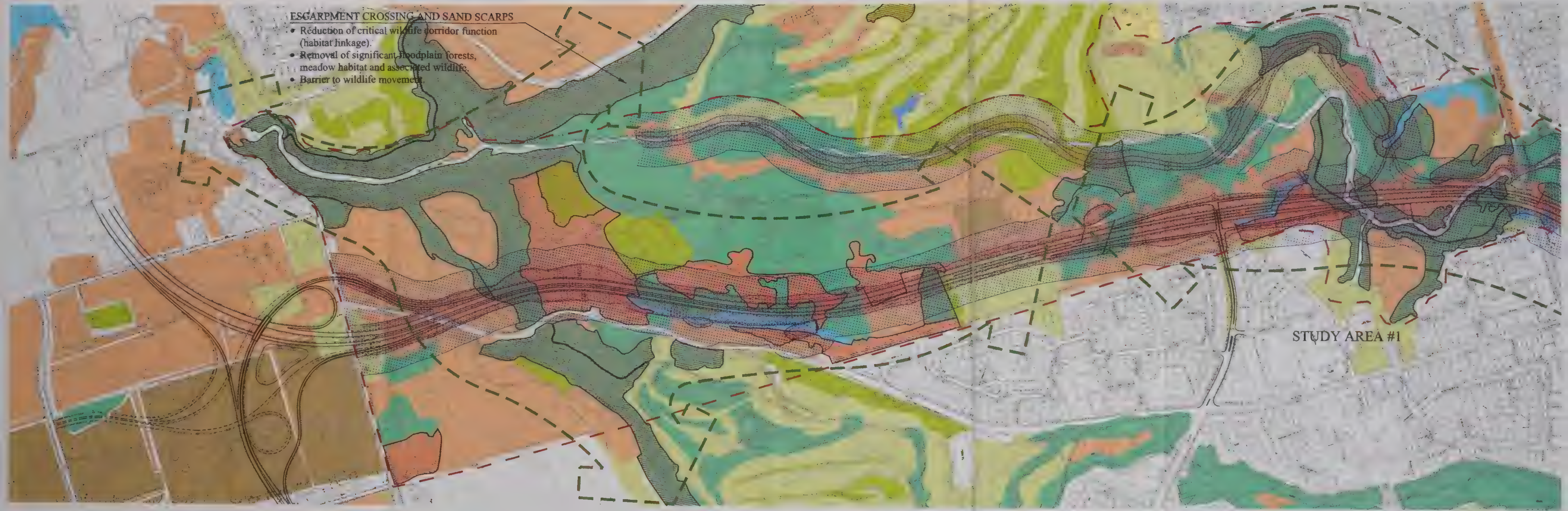
Study Area 1 – Creek Valley

Study Area 1 is bound by Mud Street to the south and Brampton Street to the north; between Brampton Street and Greenhill Avenue the east and west boundaries are defined by the Red Hill Creek valley top of slopes; between Greenhill Avenue and Mud Street, the western boundary is formed by Red Hill Creek; and the eastern boundary is formed by Glencastle Drive, Glencastle Golf Course and the City of Stoney Creek boundary (see Figure 1).

Study Area 2 – Lakeshore

Study Area 2 is bound by Brampton Street to the south, the Lake Ontario shoreline to the north; Highway 20 to the east and Burlington Street to the west (see Figure 1).





ESCARPMENT CROSSING AND SAND SCARPS

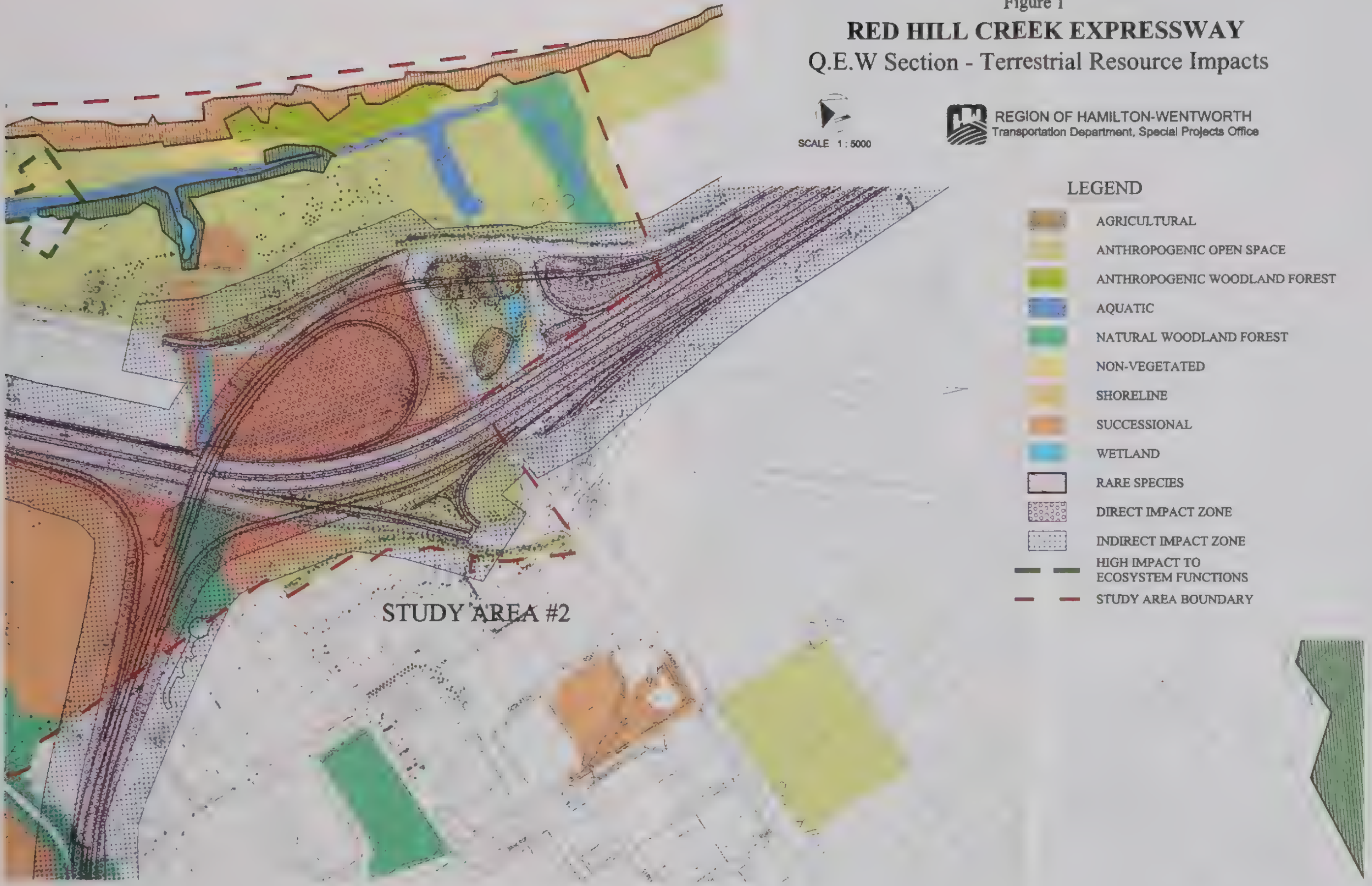
- Reduction of critical wildlife corridor function (habitat linkage).
- Removal of significant floodplain forests, meadow habitat and associated wildlife.
- Barrier to wildlife movement.

Figure 1

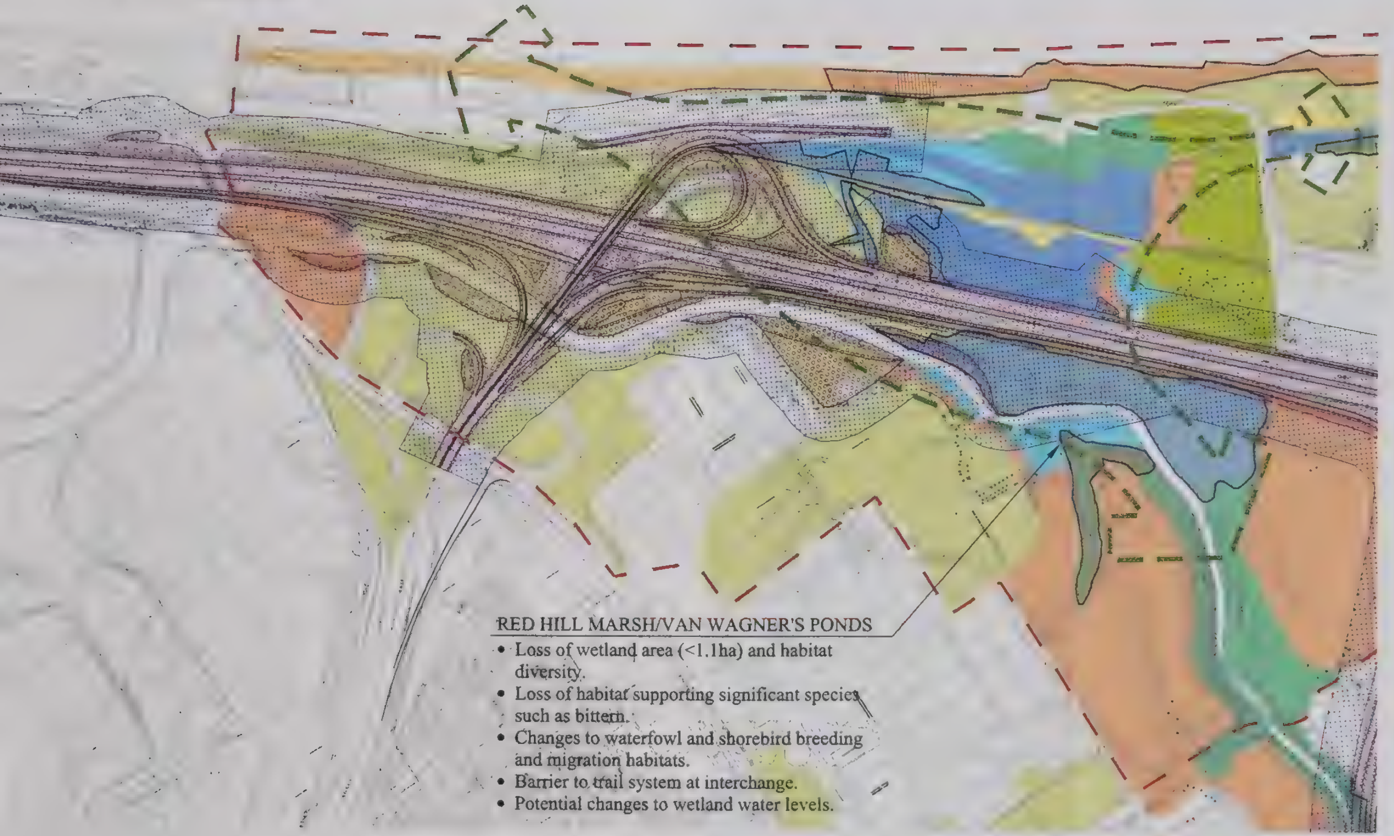
RED HILL CREEK EXPRESSWAY

Q.E.W Section - Terrestrial Resource Impacts

REGION OF HAMILTON-WENTWORTH
Transportation Department, Special Projects Office



STUDY AREA #2



RED HILL MARSH/VAN WAGNER'S PONDS

- Loss of wetland area (<1.1ha) and habitat diversity.
- Loss of habitat supporting significant species such as bittern.
- Changes to waterfowl and shorebird breeding and migration habitats.
- Barrier to trail system at interchange.
- Potential changes to wetland water levels.

Impact Zone Definition

The Project will result in direct and indirect impacts to existing terrestrial resources within Study Areas 1 and 2. Both impact types are important, but direct impacts are typically easier to predict because of their more obvious cause-effect relationships. For the purposes of the Impact Assessment, Study Area 1 was separated into a Direct Impact Zone (DIZ) and an Indirect Impact Zone (IIZ). An IIZ was not identified in Study Area 2, as it would be impractical to distinguish indirect impacts of the proposed works from the substantial background effects of the existing QEW and waterfront development.

It should be noted that additional direct impacts will undoubtedly occur as a result of mitigation activities for other factors; in particular, the construction of noise walls, and relocation of recreational facilities (trails, playing fields etc.) outside the DIZ. Design details for this component of the Project have not been resolved at the time of preparation of this report.

Direct Impact Zone

The Direct Impact Zone includes all lands that will undergo clearing and grading during expressway construction, creek realignment or other infrastructure related works (i.e. stormwater management facilities) (refer to Figure 1).

Indirect Impact Zone

The Indirect Impact Zone includes all lands within 50m of the Direct Impact Zone (refer to Figure 1). This dimension represents an averaged distance within which the most profound effects of factors such as saltspray, microclimate alteration, forest edge disturbance, and wildlife conflicts will be experienced. The IIZ does not represent the limit of impacts to linkage and other larger scale ecological functions.

Impact Prediction Criteria Development

Terrestrial Resource Impact Prediction Criteria were developed and refined specific to the needs of the Project. This approach was designed to:

1. Utilize existing quantitative and qualitative data on terrestrial resources within the Study Areas

2. Be compatible with approaches being used by other disciplines for the Impact Assessment

3. Allow consistent comparisons between types of habitats affected on the basis of area, function and significance

4. Be capable of quantitative and graphic summarization to facilitate understanding by the public.

Initially, a long list of potential indicators, and rationale for their consideration, was prepared using a tabular format provided by the Special Projects Office. This list, presented in Appendix 1, considered eight (8) indicators under the broad resource categories of Terrestrial Vegetation, Wildlife Resources, and Provincially Significant Wetlands. In addition, eight (8) indicators were identified for physical environment factors that could affect biological resources. Number of trees potentially removed was not included as a potential indicator, as documented in Appendix 4.

The long list of indicators was refined to simplify analysis and to reduce double counting of impacts while representing the widest range of issues related to existing attributes, linkages and functions. This resulted in the Final Impact Prediction Criteria that are summarized in Table 1. This approach utilized three indicators, as follows:

Indicator A: areas, relative significance, and number of habitat types to be removed (directly impacted) or potentially disturbed (indirectly impacted) by specific road-related activities.

Indicator B: area of habitats that support known rare or vulnerable species to be removed (directly impacted) or potentially disturbed (indirectly impacted) by specific road-related activities.

Indicator C: Level of impact (high, medium or low) to ecosystem functions in the defined study areas. This approach is intended to represent graphically the areas where permanent changes to function will occur, or where significant opportunities to mitigate such impacts exist. The criteria for Indicator C ratings are as follows:

High *High-level impacts include the removal or significant disturbance of natural areas resulting in the net loss of ecological functions that cannot be mitigated within the study area.*

In particular, these include the loss or disturbance of features representing:

i) habitats of irreplaceable integrity that are critical to supporting significant biota; or

ii) habitats which play a critical functional role (such as habitat linkage) that will disappear or be permanently reduced as compared to existing conditions.

Medium *Medium-level impacts include partial removal or disturbance of natural areas, affecting existing biophysical conditions (e.g. flood frequency, local microclimate, noise), however these impacts can be partially or completely mitigated and will not affect existing functions over the long term.*

Low *Low-level impacts will not permanently change the quality or ecological function of natural areas as compared to existing conditions.*

This impact prediction methodology was circulated to agencies and the Community Stakeholder Committee for comments in late February 1998. The Impact Prediction

Criteria were reviewed with the Community Stakeholder Committee (CSC) on April 7, 1998.

Comments received that related to terrestrial resources were as follows:

Environment Canada (Feb. 27/98) – Impacts on migratory bird staging areas of Red Hill Marsh/Van Wagners Marsh should be assessed.

Hamilton Region Conservation Authority (Feb. 27/98) – Fish and wildlife (ecological functions) should be addressed; type and area of wetlands to be lost should be documented.

TABLE 1: FINAL TERRESTRIAL RESOURCE IMPACT PREDICTION CRITERIA

Indicator	Description	Rationale
A	Areas, relative significance[1] and number of habitat types[2] to be *removed* by expressway construction[3], or *potentially disturbed*[4] by road-related physical changes[5] to the environment.	The expressway and related works will eliminate existing habitats (i.e. their area and diversity), remove or displace many species reliant on these habitats, and fragment habitats that remain. Habitats that are not directly removed may be degraded or altered due to physical changes associated with construction or operation of the expressway. Significant species or habitats, which are those recognized as rare or particularly high quality on a regional or provincial basis, are indicators of environmental quality. The overall functions and integrity of the valley ecosystem will change during and following construction. Medium level impacts can be mitigated, but high level impacts will likely be permanent. Impacts to educational and recreational values are considered elsewhere in the Impact Assessment.
B	Areas of habitats that support known rare or vulnerable[6] species, to be *removed* by construction[3], or *potentially disturbed*[4] by road-related physical changes[5] to the environment.	
C	Level of impact (low, medium or high) to ecosystem functions within study area sections, based on degree of fragmentation and changes to key functions[7] after expressway construction (Note: Criteria for impact levels are presented below).	

[1] Significant habitats: Carolinian, Escarpment, Provincially Significant Wetland

[2] Habitat types: upland forest, floodplain forest, successional, wetland, shoreline, plantation

[3] Construction includes: access, roadway grading, creek realignment, surface water management works, noise or visual impact abatement works.

[4] Potential disturbance: features remain but may degrade, transform or disappear over time.

[5] Physical changes to: ground and surface water quality and quantity, microclimates, soils and slope, topography, air quality, and noise.

[6] Known rare or vulnerable species: those with recognized status, including certain plant, migratory & breeding bird, small mammal, amphibian, reptile, and butterfly species.

[7] Key function categories: ground water, surface water, erosion control, and habitat integrity.

Identification of Mitigation Opportunities

Restoration and habitat enhancement opportunities within and adjacent to the valley were initially identified in the Red Hill Creek Watershed Plan based on input from the Public, Agencies, and the Watershed study team. Maps 3 and 3a of the First Generation Watershed Plan (January 1998) indicated potential locations for works including naturalization, restoration of historic communities, improvements to habitat linkage, management of degraded habitats, and creation of new wetland habitats.

Opportunities to input on additional roadway design changes to those presented in Chapter 4.4 of the Draft Summary Report, Volume 1 (November 1997), were provided to the Design Team in spring 1998. Input was requested for two specific design issues including: a) the location and configuration of the Escarpment viaduct, and b) sizing of culvert structures throughout the valley. From a terrestrial resource perspective, this presented an opportunity to recommend design changes that would increase connectivity for wildlife movement along the escarpment corridor and throughout the valley.

Red Hill Expressway – Viaduct Design Principles – Terrestrial Resources (March 11, 1998)

1. The structure should be designed to dampen vibration and to minimize reverbration of traffic noise off of adjoining rock faces.
2. Design and operational measures should be considered to confine and treat salt-laden runoff, and to reduce the extent of saltspray drift.
3. A minimum span height of 5 m would be considered optimal.
4. A minimum span length of 20 m is desirable to permit substantial sight lines for wildlife, and to encourage movement by larger mammals. Longer spans will provide greater movement options for wildlife.
5. The span position and length, and abutment placement should be set to reflect key wildlife movement loci (where possible), which include a) forest edge along crest of Escarpment; b) forest edge along toe of Escarpment; and c) network of linked depressions/swales in successional meadow up to 100 m north of forested Escarpment slope.
6. The north face of the Escarpment should be exposed if possible beneath the viaduct (i.e. exposed bedrock), preferably to a height of at least 5 m. This will permit growth of cliff-dwelling plants and nesting options for cliff-dwelling birds along the east and west edges of the span opening.
7. The natural form of the lower face and toe of the Escarpment should be maintained or recreated below the structure to provide contiguous habitat structure.
8. Seepage zones should be identified and integrated as habitat elements as part of detailed design.

9. Opportunities to maximize light penetration below the structure should be explored including greater viaduct height, narrowed roadway, or slight re-orientation of the deck.
10. At least one 'daylight' option should be available for wildlife moving in each direction. That is, there should be unimpeded sight lines through and beyond the opening, extending into relatively open habitat (e.g. meadow) on the opposite side.
11. Apart from pedestrian trails, the surface cover under the structure should contain pockets of shrubs and groundcovers where light is available, with the balance of the area to be provided with a rough texture (talus, scattered boulders) to collect organic debris, provide cover for wildlife, and to discourage human traffic/partying except along the defined trails.
12. Opportunities to direct wildlife movement from above to below the Escarpment (i.e. within the road cut) should be examined in order to reduce roadkills.
13. Artificial lighting under the structure should be avoided if possible.
14. Design measures to trap roadside garbage, facilitate its removal, and thereby prevent its movement into the adjoining natural area should be considered.

Note: Following a site meeting & tour the idea of multiple openings under Expressway emerged as a consideration.

Red Hill Culvert/Bridge Crossing Criteria – Terrestrial Resources (March 17/98)

The valley downstream of the Greenhill SWMF will undergo severe fragmentation affecting natural systems and human movement. To retain some connectivity for wildlife movement, structures which bridge the primary remaining valley 'link' would require consistent openings of at least 30+ m (overall) x 4 m. The alignment of mainline and ramp structures to provide consistent floodplain connections will affect the value of these connections after construction. Detailed design criteria are required to address key connections for wildlife and humans, as well as aesthetics, safety and security.

Enhancement of habitat connectivity along Davis Creek could mitigate some of the habitat loss in the lower valley. This would require a concerted strategy to replace existing constrictions and augment terrestrial habitat along the valley, through existing Quigley Rd. and Mt. Albion Rd. crossings.

For smaller culverts, minimizing lengths and designing outlets to be accessible to various aquatic species would be desirable. There may also be an opportunity for smaller metal culverts, to serve as potential movement points from the main valley into new wetlands. These could be placed above or within the flood envelope.

Landscape & Restoration Advisory Group (LRAG)

A Landscape & Restoration Advisory Group (LRAG), representing local expertise in landscaping and restoration, was established in January 1998 as part of the Impact Assessment process. In March 1998, LRAG devoted two meetings to detailed identification

of habitat restoration and mitigation sites in the vicinity of the approved Expressway corridor. In addition, members of the Design Team (representing the fisheries, terrestrial and surface water disciplines) met and identified potential wetland and fish habitat enhancement opportunities in the vicinity of the Queen Elizabeth Way between Burlington Street and the Red Hill Expressway interchange.

Opportunities identified to date have been summarized on Mitigation Maps 3A & 3B in the Draft Summary Report, Volume 2 (June 1998). The primary mitigation activities will be addressed in detail by the Landscape Management Plan currently being prepared by Hough Woodland Naylor Dance and Leister. Ultimately, the finalized Landscape Management Plan will address all natural environment mitigation activities, based on requirements of agencies, feasibility (i.e., soil contamination studies and landowner agreements), negotiations with affected community stakeholders, experience on the 'Linc', and budgetary commitment by the Region.

From the standpoint of terrestrial resources, four categories of mitigation to be employed on the Project have been identified to date, as summarized below:

Protection & Conservation

Measures can be taken to protect and thereby conserve existing natural habitats from the disturbances of the Expressway and related works. For example, during the detailed design of the creek channel relocation, there will be opportunities to avoid disturbance to certain significant tree groupings, individual trees, and local populations of significant plant species. Similarly, protection of wooded valley slopes is considered a priority as much of the floodplain will be subjected to removal of existing forest cover, and the slopes represent one of the main sources of propagules.

In some cases the position and extent of other mitigation features (stormwater ponds, noise barriers, screen plantings) can be adjusted during detailed design to better integrate and/or protect existing features. The selection of appropriate native plant materials for replanting in the direct impact zone may serve to protect existing native communities in adjacent areas. Plantings and bioengineering works may be required to stabilize disturbed areas and prevent degradation of adjoining intact habitats.

Biodiversity Recycling

Many opportunities exist along the Expressway and stream relocation corridors, to salvage seed and existing plants for eventual re-use in the valley or other suitable areas.

Seed collection in appropriate seasons, propagation, and contract growing of plant materials will be necessary in order to provide an adequate supply of locally-adapted native plants. This work must be initiated 2-5 years in advance of re-planting to be successfully applied to a range of plant materials. The objectives are three-fold: a) to provide a range of

locally-adapted species for use in re-planting of disturbed areas; b) to provide sources of native species that are currently unavailable in the nursery trade; and c) to conserve local populations of rare or otherwise significant species.

Soil seedbanks represent a major salvage opportunity, particularly for wetland and riparian habitat restoration work. Seedbanks represent topsoil in existing habitats; they contain relatively high concentrations of seed, rhizomes and bulbs. When used to top-dress regraded landscapes, they quickly yield diverse regrowth dominated by native species. The removal, storage and reuse of seedbanks requires excavation equipment, storage facilities, and in particular, careful phasing to match donor and recipient sites.

Larger salvage units, such as sods and tree stumps, can be utilized to establish core areas of biodiversity within extensive areas of replanting. Sods can be effectively used for re-establishment of wet meadow and marsh vegetation in areas with comparable drainage and flooding regimes. Sods of shrub colonies (such as those formed by gray dogwood) can be lifted with appropriate equipment for use in restored creek bank and other riparian settings. Stumps of trees can be lifted with portions of the lateral root systems left intact. These roots hold soil and microflora, and become nuclei for rapid regeneration of diverse tree, shrub and groundcovers when installed in planted areas. They also provide structure for bird and small mammals nesting. Specialized equipment is available to facilitate large scale salvage operations. Once again, careful attention to phasing is required to match donor and recipient sites.

Habitat Enhancement & Creation

Opportunities exist in the valley and lakeshore areas to enhance existing degraded habitats and to create additional habitats to partially offset the loss of those removed by the Expressway and related works. In the upper valley, opportunities exist to convert some managed open space into areas of natural forest cover that may improve the sustainability of forest wildlife populations. As indicated on Map 3B, the QEW area contains relatively extensive areas of vacant land, closed landfill areas, and interchange areas where existing early successional habitats can be enhanced to yield forest, shrubland, meadows, and wetlands. Extensive areas along the lower Creek are proposed to be regraded to create floodplain storage and marsh habitats. However, these areas must first be assessed for soil contamination levels.

The study areas will contain more extensive wetland cover following Expressway development. This will result from the creation of 17 water quality wet ponds/wetlands (above and below the Escarpment, and along the QEW), possible creation of additional floodplain wetlands along the lower creek channel, and increased incidence of floodplain inundation downstream of King Street due to channel relocation. There are opportunities to enhance the biological functions of the Provincially Significant Wetland by regrading of previously filled areas, introduction of accessible gravel beds and logs to support turtles and

birds, and provision of plantings to reduce the existing visual interference of the QEW and local roads.

The Escarpment crossing as currently proposed will create new faces of exposed limestone bedrock up to 15 metres in height. These new faces can be designed to support threatened Escarpment habitats such as cliff rim, cliff face and talus communities. Similarly, new faces of Queenston shale will be exposed in the lower valley that can sustain early successional communities. The incorporation of salvage and seedbank approaches during construction can enhance the quality of the created communities.

Habitat Management on a Watershed Level

The Watershed Plan (1998) identified valley problems, possible enhancement strategies, and areas of opportunity to improve sustainability of the natural systems remaining in the Watershed. This included planting of native trees and other stewardship activities in the neighbourhoods bordering the Niagara Escarpment and valley rim.

Certain specialized habitats require management to ensure their sustainability. In particular, the dry sand scarps below the Escarpment support regionally significant dry meadow plants and associated wildlife. Periodic burning or mowing of key meadows will prevent the loss of these habitat elements.

Determination of Net Impacts

Net impacts are those persisting after mitigation has been fully applied. As discussed above (see Identification of Mitigation Opportunities), the finalized Landscape Management Plan will address all natural environment mitigation activities, based on requirements of agencies, feasibility studies (i.e. soil contamination studies and landowner agreement), negotiations with affected community stakeholders, and budgetary commitment by the Region. The Landscape Management Plan is still under preparation.

For the purposes of the present draft report, the aerial loss of existing habitats (i.e. Indicators A and B) due to the Expressway, impacts to existing functions (Indicator C) and cumulative impacts have been assessed and quantified where reliable data exists. In addition, the repercussions of the Expressway on Environmentally Sensitive Area criteria and characteristics of the Provincially Significant Wetlands can be summarized based on available background information and GIS data.

The calculation of overall net habitat loss (Indicator A) cannot be finalized until mitigation plans are completed, approved and successfully implemented.

Findings

Impact Assessment

Indicator A (Habitats)

Tables 2 and 3 summarize impacted habitat types and extent of habitat loss (area in hectares) in Study Areas 1 and 2 respectively.

Study Area 1

- Open Space (Recreational Areas & Maintained Sites) **[7.7 ha]**
- Anthropogenic Woodland/Forest (Plantations & Cultural Woodlands) **[0.1 ha]**
- Natural Woodland/Forest (Upland, Lowland, Floodplain and Escarpment) **[36.7 ha]**
- Successional (Old Field, Thickets and other Regeneration Areas) **[28.3 ha]**
- Wetland (Marsh and Swamp) **[2.3 ha]**

Study Area 2

- Open Space (Recreational Areas & Maintained Sites) **[7.1 ha]**
- Anthropogenic Woodland/Forest (Plantations & Cultural Woodlands) **[0.15 ha]**
- Natural Woodland/Forest (Upland, Lowland, Floodplain and Escarpment) **[1.14 ha]**
- Successional (Old Field, Thickets and other Regeneration Areas) **[8.8 ha]**
- Wetland (Marsh) **[0.5 ha]**
- Aquatic (Open Water) **[0.11 ha]**

Indicator B (Attributes)

Area estimates (in hectares) of significant species habitat to be removed by project construction are as follows:

The total area of habitats known to support significant species in Study Area 1 is 88.2 ha. Approximately 20 % (18.0 ha) will be removed by project construction (i.e., clearing, grubbing, grading, creek realignment, stormwater management). An additional 27 % (or 24.0 ha) located within 50 m of the project grading limits may be subjected to varying levels of indirect impacts (i.e. salt spray, rapid microclimate change, etc.).

The extent of habitat known to support significant species in Study Area 2 is 13.1 ha Significant plant and wildlife species are associated with wetland and shoreline habitats

Approximately 6 % (or 0.75 ha) of significant species habitat will be removed by project construction. Significant plant and wildlife species to potentially be removed or displaced by project construction and expressway operation include the following:

Plants

- A total of 43 significant plant species are known to occur in Study Areas 1 & 2, including 12 regionally rare species and 31 regionally uncommon species;
- Study Area 1 supports 35 significant plant species that may be potentially impacted, including 9 regionally rare species and 29 regionally uncommon species;
- Study Area 2 supports 7 significant plant species that may be potentially impacted, including 5 regionally rare species and 2 regionally uncommon species.

Wildlife

- Two Regionally rare butterfly species, the Northern Cloudywing and Hickory Hairstreak;
- Two Vulnerable bird species, the Least Bittern and Cooper's Hawk;
- A Regionally rare bird species, the Carolina Wren; and a Vulnerable mammal species, the Southern Flying Squirrel.

Lists of individual species of significant flora and fauna potentially impacted by the Project are presented in Appendices 2 & 3 respectively.

Indicator C (Functions)

High-level impacts will occur throughout the Red Hill Creek valley system including the re-entrant section into the Niagara Escarpment. This is due to removal of significant habitats (Carolinian floodplain and slope forests, dry meadows and wetlands); and loss of critical linkages along the affected primary and secondary linkage corridors (i.e., Red Hill Creek Valley, Niagara Escarpment and Davis Creek valley). High-level impacts will also be sustained by the Provincially significant Van Wagner's Marsh wetlands including the loss of wetland area and removal of habitat utilized by significant plant and wildlife species.

Medium-level impacts will occur in less sensitive or more resilient habitats adjacent to areas cleared for project construction (i.e. recreational areas, immature forests and successional areas, etc.), and in habitats that will be temporarily affected or potentially enhanced by project construction.

Low-level impacts are anticipated in areas located beyond the study area boundaries and in existing severely degraded habitats adjacent to project construction.

Figure 1 summarizes those areas within the limits of the study area that will sustain high-level impacts to ecological functions.

Net Impacts

Net impacts have been identified at the time of preparation of this draft report but may be subject to change based on the mitigation strategies adopted. The net impacts may be summarized as follows:

Corridor Functions

There will be net loss of primary and secondary linkage functions affecting the Niagara Escarpment, Red Hill Creek valley (and hence Van Wagner's Marsh and the lakeshore), and Davis Creek corridors. This is due to permanent additional fragmentation of forested and successional areas created by the road and ramps, despite the application of design criteria for the viaduct, culverts and bridges. North of King Street most of the remaining natural habitat fragments in the valley will fall below the critical value of 100 m in width. This, in conjunction with urban impacts documented in the Watershed Study, and new disturbance created by construction, will reduce the ability of the remaining areas to sustain their present level of biodiversity. Mitigation opportunities are limited by the scale of the road within the lower valley, and the surrounding urban environment.

Bird Migration & Staging

There will be significant loss of available natural habitat and increased mortality for migratory birds and other wildlife, but migratory use will probably continue based on available information for similar disturbed migration routes associated with major geomorphic features in the Great Lakes region. Additional habitat creation, if implemented, may therefore help to compensate for some of the loss.

Existing staging areas of the Provincially Significant Wetland will remain intact but their attractiveness to migrating waterfowl, particularly for breeding purposes, is already in question. Some improvement may occur if proposed wetland enhancements are implemented.

Significant Habitats and Species

There will be substantial permanent loss of remnant significant habitats and the species they support, including Carolinian floodplain and slope forests, dry meadows, and wetland communities. This may be partially mitigated if proposed habitat restorations and wetland works are implemented. However, the created systems are unlikely to sustain the biodiversity, structure and integrity of existing habitats, due to overall fragmentation and dilution of native seed sources which would normally support natural successional processes.

Changes to Hydroperiod

There will be increased influence of hydrologic events on remaining floodplain vegetation downstream of Greenhill Ave., due to the predicted increase in the number of annual overbank flooding events along the realigned channel. This will increase the riparian and wetland character of the plant communities, and may attract aquatic wildlife. However, the frequency and urban character of the runoff events will interfere with natural succession, and generate monocultural growth, comprised primarily of exotic species, in affected areas of the valley.

The effects of changes to hydrology of the Van Wagners Ponds & Marshes Wetland have not been ascertained at this stage of design. There is some uncertainty as to the relative inflows and outflows sustaining the Ponds in their present form. These will require clarification as part of detailed design related to culvert connections and flood performance.

PSW Status

With respect to the Provincially Significant Wetland, the following impacts are predicted, in accordance with functional attributes under the Ontario Wetland Evaluation System (1993) and measures in the Provincial Wetland Policy (1992). Those that may be at least partially addressed through the proposed mitigation activities are highlighted - (M).

➢ Net Loss of Wetland Functions including:

Biological
- Reduction in diversity of wetland communities & surrounding habitats (M)
- Reduced structural diversity of available habitats (M)

Social
- Alteration of existing recreational opportunities & research uses (M)

Hydrological
- Adjustment of upstream and local drainage systems (M)
- Potential changes to water quality (M)
- Potential changes to shallow groundwater systems sustaining significant plant communities (quantity/nutrients) (M)

Special Features
- Interference with waterfowl and shore bird habitat uses ("vulnerable" species affected) (M)
- Interference with fish habitat (M)
- Removal of and interference with habitats of significant plant species (provincial, regional and local significance; includes wetland and upland species) (M)

- Subsequent Demand for future Development; there is a high likelihood that the infrastructure being provided will be rebuilt or upgraded in the future.

- Loss of contiguous Wetland Area; approximately 0.6 ha of existing wetland will be removed (M)

The effect of the QEW works on the Provincially Significant status of Van Wagner's Marsh and Ponds is unclear. Based on available background information (as summarized in the Background Inventory Report, October, 1997) several of the rare or vulnerable wildlife species which formed the basis of the wetland score are apparently no longer resident or breeding in the wetland under existing impact conditions. However, regionally rare plant species, have come to light in the wetland in the past year which would affect the wetland score. The wetland data record should therefore be updated through a re-evaluation.

ESA Status

With respect to the Red Hill Valley ESA #52, 5 out of the 6 criteria used in its designation will continue to apply after the Expressway is built. Criterion 2, which relates to linkage functions between the valley and the lakeshore functions will no longer be applicable. Conditions addressed under Criteria 3, 5, and 6, which relate to habitat for rare species, will undergo substantial net changes as discussed above, but the criteria should continue to apply.

With respect to the Van Wagner's Pond ESA #50, the two criteria, 4 and 6 should remain applicable. Habitat for significant species (Criterion 6) has undergone negative changes as discussed above, but the criteria should continue to apply after the Expressway works are completed.

TABLE 2. EXTENT OF DIRECT AND INDIRECT IMPACTS TO TERRESTRIAL RESOURCES IN STUDY AREA1

Vegetation Communities & Habitat Types*	**Watershed**	**Study Area**[1]	**Direct Impact Zone**[2]	**Indirect Impact Zone**[3]
Agricultural (ha)	444.3	1.3	-	0.1
Anthropogenic Open Space (ha)	390.9	42.1	7.7	10.1
Anthropogenic Woodland/Forest (ha)	49.3	12.1	0.1	2.4
Aquatic (ha)	7.2		-	-
Natural Woodland/Forest (ha)	455.3	137.0	36.7	35.9
Shoreline (ha)	8.3	-	-	-
Successional (ha)	705.2	94.4	28.3	25.1
Unvegetated (ha)	20.0	-	-	-
Wetland (ha)	26.6	4.2	2.3	0.67
Total Area (ha)	6833.7	324.2	92.5	109.7
Total Natural Area (ha)	2087.1	292.0	75.1	74.3

[1] *The **Study Area** is bound by Mud Street to the south and Brampton Street to the north; between Brampton Street and Greenhill Avenue the east and west boundaries are formed by the Red Hill Creek valley; between Greenhill Avenue and Mud Street, the western boundary is formed by Red Hill Creek; the eastern boundary is formed by Glencastle Drive, Glencastle Golf Course and the City of Stoney Creek boundary (refer to Figure 1).*

[2] *The **Direct Impact Zone** includes all lands that will be subject to clearing and/or grade modification, either from expressway construction, creek realignment work or infrastructure related works (i.e. stormwater management facilities) (refer to Figure 1).*

[3] *The **Indirect Impact Zone** includes all lands within 50m of the Direct Impact Zone (refer to Figure 1)*

**Vegetation Community & Habitat Types are comprised as follows (for further details refer to the IADP Technical Report):*

***Agricultural** – Cultivated fields, Nurseries and Orchards; **Anthropogenic Open Space** – Maintained Lawn, Recreational Areas, Ornamental Plantings; **Anthropogenic Woodland/Forest** – Plantations, Cultural Woodlands and Non-Native Forests; **Aquatic** – Open and Shallow Water Wetlands; **Natural Woodland/Forest** – Upland, Lowland, Cliff, Talus and Floodplain Forests and Woodlands; **Shoreline** – Beach Bars **Successional** – Old Field, Shrub Thickets, Regeneration Areas; **Wetland** – Meadow Marsh, Shallow Marsh, Swamp Forest*

TABLE 3. EXTENT OF POTENTIAL IMPACTS TO TERRESTRIAL RESOURCES IN STUDY AREA 2

Vegetation Communities & Habitat Types*	**Study Area[1]**	**1990 Option**	**Redhill Option "A" Burlington Street Preferred Option C1**
Anthropogenic Open Space (ha)	53.4	8.8	7.1
Anthropogenic Woodland/Forest (ha)	6.4	2.1	0.15
Aquatic (ha)	6.8	0.54	0.11
Natural Woodland/Forest (ha)	7.6	0.5	1.14
Shoreline (ha)	7.2	-	-
Successional (ha)	27.9	3.0	8.8
Unvegetated (ha)	1.9	0.02	0.1
Wetland (ha)**	11.7	1.44	0.5
Total Area (ha)	179.4	n/a	n/a
Total Natural Area (ha)	121.0	16.4	17.8

[1] ***Study Area 2*** *is bound by Brampton Street to the south, the Lake Ontario shoreline to the north; Highway 20 to the east and Burlington Street to the west (refer to Figure 1).*

*** Estimates of wetland area impacted are based on the assumption that roadway crossings will be on structure to minimize wetland loss.*

**Vegetation Communities & Habitat Types are comprised as follows (for further details refer to the IADP Technical Report):*

Anthropogenic Open Space – Maintained Lawn, Recreational Areas, Ornamental Plantings; **Anthropogenic Woodland/Forest** – Plantations, Cultural Woodlands and Non-Native Forests; **Aquatic** – Open and Shallow Water Wetlands; **Natural Woodland/Forest** – Upland, Lowland, Cliff, Talus and Floodplain Forests and Woodlands; **Shoreline** – Beach Bars; **Successional** – Old Field, Shrub Thickets, Regeneration Areas; **Wetland** – Meadow Marsh, Shallow Marsh, Swamp Forest.

Appendices

APPENDIX 1: LONG LIST OF POTENTIAL TERRESTRIAL RESOURCE IMPACT PREDICTION CRITERIA

Natural Environment	Indicator	Rationale
Terrestrial Vegetation	***Community Type*** Measures of Potential Impact Include: ☐ Net loss of community types ☐ Net loss of community area ☐ Net loss of significant community types ☐ Net loss of significant community area	Number of community types is an important measure of ecosystem functions. Community types considered significant in the Watershed include wetlands, Escarpment habitats, dry successional meadows and Carolinian forest. The Expressway may remove or degrade these habitats, thereby reducing the quality of the remaining habitats.
	Community Size & Connectivity Measures of Potential Impact Include: ☐ Net loss of contiguous community area ☐ Net loss of corridor linkage (length & area)	Communities with extensive core areas, stable edges, and good linkages to nearby habitats, have higher levels of ecosystem function. Expressway development may reduce and fragment these areas, which will reduce the ability of the Valley to support diverse communities and species.
	Significant Species Measures of Potential Impact Include: ☐ Net loss of known significant species ☐ Net loss of suitable habitat	Significant plant species are those considered rare or uncommon on a local, Regional, or provincial basis. They are often associated with specialized habitats, habitats of exceptional quality, or extensive core areas of habitat. The loss of these species, and loss or degradation of their special habitats may eventually contribute to their extinction.

APPENDIX 1: LONG LIST OF POTENTIAL TERRESTRIAL RESOURCE IMPACT PREDICTION CRITERIA

Natural Environment	Indicator	Rationale
Wildlife Resources	***Habitat Type*** Measures of Potential Impact Include: ☐ Net loss of habitat types ☐ Net loss of habitat (removed or degraded) ***Habitat Size & Connectivity*** Measures of Potential Impact Include: ☐ Net loss of habitat corridor (area removed or degraded) ☐ Net increase in fragmentation ***Significant Species*** Measures of Potential Impact Include: ☐ Net loss of suitable habitat	Wildlife habitat types represent different plant communities which are used to complete the life cycles of particular wildlife groups. The Expressway may remove or degrade portions of habitat, thereby reducing the ability of the Valley to support quality wildlife species. Larger areas of habitat, with stable edges, and good linkages to nearby habitats, provide a greater opportunity for successful wildlife usage. Fragmentation and degradation due to Expressway development may reduce or eliminate populations of quality wildlife species. Significant wildlife species are those considered rare or uncommon on a local, Regional or Provincial basis. They are often associated with specialized site conditions, large core areas of habitat, or habitats of exceptional quality. Degradation or loss of these habitats may contribute to their extinction. (Note: Significant wildlife may not utilize a particular site every year; for that reason, suitable habitat is used as a measure).

APPENDIX 1: LONG LIST OF POTENTIAL TERRESTRIAL RESOURCE IMPACT PREDICTION CRITERIA

Natural Environment	Indicator	Rationale
Provincially Significant Wetlands	***Loss of Wetland Functions*** Measures of Potential Impact Include: ☐ Net loss of plant communities ☐ Net loss of wetland area ☐ Net loss of significant plant or wildlife species ☐ Net loss of suitable habitat for significant species ***Loss of Contiguous Wetland Area*** Measures of Potential Impact Include: ☐ Net loss of wetland area	The Biological and Special Features functions of the PSW are addressed here in accordance with the Provincial Wetland Policy (1992). Loss of function may also include altered hydrology, changes to educational / recreational functions, or loss of fish habitat; please see evaluation criteria under Cultural Resources, Surface Water and Fisheries.
Physical Environment	***Soils and Physiography*** Measures of Potential Impact Include: ☐ Net area of significant soil features altered ☐ Net area of native soil disturbed ***Slopes and Topography*** Measures of Potential Impact Include: Net area re-graded	Specialized vegetation communities (e.g Escarpment habitats, dry meadows, floodplains) are reliant on specific soil and physiographic conditions. Removal or degradation of soils may affect adjoining habitats. Undisturbed slopes often contain stable plant communities with no maintenance needs. In addition, local topography may contribute to habitat diversity and biodiversity. Expressway development may replace existing topography with more uniform grading, and higher maintenance requirements.

APPENDIX 1: LONG LIST OF POTENTIAL TERRESTRIAL RESOURCE IMPACT PREDICTION CRITERIA

Natural Environment	Indicator	Rationale
Physical Environment	***Surface Water*** Measures of Potential Impact Include: ☐ Net area regraded ☐ Net area of altered hydroperiod	Surface drainage and hydrologic conditions relate to soil structure, slopes, topography and vegetative cover. Poorly drained sites are more susceptible to slight changes than better drained sites. Floodplain and wetland communities are adapted to existing flow regimes, flood patterns (hydroperiods) and water quality. The Expressway and related surface water management may affect these delicate balances.
	Water Quality Measures of Potential Impact Include: (Refer To Surface Water Impact Assessment)	Water-borne contaminants (road salt and others) will alter plant and animal community composition in downstream receiving areas.
	Hydrogeology Measures of Potential Impact Include: ☐ Net discharge area affected ☐ Net recharge area affected	Certain vegetation communities and wildlife species are reliant on groundwater recharge and discharge zones. Slight changes to the groundwater flows may alter these natural resources.
	Microclimate Measures of Potential Impact Include: ☐ Net area of sensitive habitats affected	Topography, air movement patterns, radiation (solar and reflected), moisture levels, and vegetative growth all contribute to the development of complex microclimates. Changes to microclimate may alter vegetation communities, reduce the ability of habitats to support sensitive species, and affect disease patterns.

APPENDIX 1: LONG LIST OF POTENTIAL TERRESTRIAL RESOURCE IMPACT PREDICTION CRITERIA

Natural Environment	Indicator	Rationale
	Air Quality Measures of Potential Impact Include: Net area in primary salt spray zone Other measures (ozone, NOX etc?)	Poor air quality affects physiological functions and health of plants, animals and soil organisms. Forest decline may be linked to vehicular emissions. Salt spray from road de-icing affects woody and herbaceous plants located up to 150 m from most expressways.
	Noise Measures of Potential Impact Include: (refer to Noise Impact Assessment)	Noise pollution may affect certain wildlife species, causing relocation or behavioural changes that may reduce breeding success and alter foraging patterns.

APPENDIX 2: POTENTIALLY IMPACTED SIGNIFICANT PLANT SPECIES OF THE RED HILL CREEK VALLEY

		*STATUS									
Scientific Name	Common Name	I	N	P	R	HW	hw	Sites in H-W	SA1	SA2	PI
Ambrosia trifida	Giant Ragweed					X		2	X	X	PI
Amelanchier sanguinea	Dwarf Juneberry						X	8	X		PI
Andropogon gerardii	Big Bluestem	X					X	6	X		PI
Arabis canadensis	Sicklepod						X	9			
Arabis laevigata	Smooth Rock Cress					X		4	X		PI
Ascepias exaltata	Poke Milkweed						X	9	X		PI
Asplenium rhizophyllum	Walking Fern						X	8			
Aster laevis	Smooth Aster						X	10	X		PI
Astragalus canadensis	Canada Milk Vetch				X	X		3		X	PI
Botrychium multifidum	Leather-leaved Grape Fern					X		2			
Bouteloua curtipendula	Side Oats Grama	X	X	X	X			1	X		PI
Bromus latiglumis	Tall Brome					X		3			
Cakile edentula	Sea Rocket					X		2			
Campanula americana	Tall Bellflower				X		X	6			
Cardamine bulbosa	Spring Cress						X	10			
Carex artitecta	Sedge					X		3			
Carex atherodes	Slough Sedge					X		2	X	X	PI
Carex aurea	Golden Sedge						X	8	X		PI
Carex cephalophora	Oval-headed Sedge						X	10			
Carex communis	Common Sedge						X	7	X		PI
Carex eburnea	Ivory Sedge						X	7			
Carex flava	Yellow Sedge						X	8			
Carex hirtifolia	Hairy Sedge						X	9			
Carex hitchcokiana	Hitchcock's Sedge						X	7	X		PI
Carex lanuginosa	Wooly Sedge						X	9	X	X	PI

* Status based on "The Vascular Plant Flora of the Regional Municipality of Hamilton Wentworth, Ontario" Goodban (1995).

I = Introduced or Planted; **N** = Rare in Canada (Argus & Pryer 1990); **P** = Rare in Ontario (Argus *et al.* 1982-87); **R** = Rare in the former OMNR Central Region (Riley 1989); **HW** = Rare in Hamilton-Wentworth Region (1-5 regional sites);**hw** = Uncommon in Hamilton-Wentworth Region (6-10 regional sites); **Sites in H-W** = Number of Regional Stations for the species; **SA1** = Study Area1; **SA2** = Study Area2; **PI** = Potentially Impacted

APPENDIX 2: POTENTIALLY IMPACTED SIGNIFICANT PLANT SPECIES OF THE RED HILL CREEK VALLEY

		*STATUS									
Scientific Name	**Common Name**	**I**	**N**	**P**	**R**	**HW**	**hw**	**Sites in H-W**	**SA1**	**SA2**	**PI**
Carex molesta	Troublesome Sedge						X	9			
Carex plantaginea	Plantain-leaved Sedge						X	6	X		PI
Carex scabrata	Rough Sedge						X	6	X		PI
Carex sparganoides	Bur-reed Sedge						X	9	X		PI
Carex tuckermanii	Tuckerman's Sedge						X	7			
Carex umbellata	Umbellate Sedge				X			4			
Carex woodii	Wood's Sedge						X	10	X		PI
Chamaesyce polygonifolia	Seaside Spurge					X		1			
Chenopodium capitatum	Strawberry Blite						X	6			
Comandra umbellata	Bastard Toadflax						X	9			
Coreopsis lanceolata	Lance-leaved Coreopsis	X	X	X	X	X		2	X		PI
Cornus florida	Flowering Dogwood						X	10			
Crataegus pringelei	Hawthorn						X	6			
Cyperus odoratus	Coarse Cyperus					X		2	X		PI
Danthonia spicata	Poverty Oat Grass						X	10	X		PI
Desmodium canadense	Showy Tick-trefoil						X	10			
Dicentra cucullaria	Dutchman's Breeches						X	9			
Dioscorea quaternata	Wild Yam						X	10	X		PI
Dryopteris goldiana	Goldie's Fern				X			4			
Elymus riparius	Riverbank Wild Rye					X		4	X		PI
Erythronium albidum	White Trout Lily					X		4	X		PI
Festuca subverticillata	Nodding Fescue						X	6	X		PI
Fraxinus quadrangulata	Blue Ash	X	X	X	X			1	X		PI
Galium lanceolatum	Lance-leaved Licorice						X	9			
Glyceria grandis	Tall Manna Grass						X	6			
Helianthus divaricatus	Woodland Sunflower						X	8	X		PI

* Status based on "The Vascular Plant Flora of the Regional Municipality of Hamilton Wentworth, Ontario" Goodban (1995).

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APPENDIX 2: POTENTIALLY IMPACTED SIGNIFICANT PLANT SPECIES OF THE RED HILL CREEK VALLEY

		*STATUS									
Scientific Name	**Common Name**	**I**	**N**	**P**	**R**	**HW**	**hw**	**Sites in H-W**	**SA1**	**SA2**	**PI**
Heracleum lanatum	Cow Parsnip						X	10	X		PI
Hybanthus concolor	Green Violet		X	X	X	X		6			
Impatiens pallida	Yellow Touch-me-not						X	10	X		PI
Juncus articulatis	Jointed Rush						X	9			
Juncus balticus	Baltic Rush					X		4		X	PI
Juncus bufonius	Toad Rush						X	9	X		PI
Lespedeza capitata	Round Headed Bush Clover				X			11	X		PI
Lespedeza hirta	Hairy Bush Clover				X		X	6	X		PI
Muhlenbergia tenuiflora	Slender Satin Grass		X	X	X	X		1			
Oryzopsis asperfolia	Rough-leaved Mountain Rice						X	9	X		PI
Oryzopsis racemosa	Nodding Mountain Rice						X	7			
Panicum latifolium	Broadleaf Panic Grass					X		4	X		PI
Panicum virgatum	Switch Grass	X				X		1	X		PI
Pedicularis canadensis	Wood Betony						X	10			
Penstomen digitalis	Beard Tongue						X	10	X		PI
Phytolacca americana	Pokeweed					X		5			
Platanthera lacera	Ragged Fringed Orchid						X	7			
Platanus occidentalis	Sycamore					X		4	X		PI
Polygonum pensylvanicum	Bigseed Smartweed						X	10			
Polygonum virginianum	Jumpseed						X	8	X		PI
Polymnia canadensis	Small-flowered Leaf-cup						X	6			
Potentilla anserina	Silverweed						X	7		X	PI
Potomogeton pectinatus	Sago Pondweed					X		5		X	PI
Prunus americana	Wild Plum						X	8			
Ptelea trifoliata	Hop Tree	X						1	X		PI
Quercus muehlenbergii	Chinquapin Oak				X			11			

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APPENDIX 2: POTENTIALLY IMPACTED SIGNIFICANT PLANT SPECIES OF THE RED HILL CREEK VALLEY

		*STATUS									
Scientific Name	**Common Name**	**I**	**N**	**P**	**R**	**HW**	**hw**	**Sites in H-W**	**SA1**	**SA2**	**PI**
Quercus velutina	Black Oak						X	9	X		PI
Rudbeckia laciniata	Cut-leaved Coneflower						X	6	X		PI
Scirpus fluviatilis	River Bulrush					X		2			
Scirpus pendulus	Nodding Bulrush						X	7	X		PI
Scirpus pungens	American Bulrush					X		3			
Scrophularia marilandica	Carpenter's Square						X	9	X		PI
Sheperdia canadensis	Soapberry					X		4			
Schizachne purpurascens	False Melic Grass						X	6	X		PI
Schizachyrium scoparium	Little Bluestem	X				X		4	X		PI
Solidago bicolor	White Goldenrod						X	9			
Solidago hispida	Hairy goldenrod					X		5			
Taenidia integerrima	Yellow Pimpernel						X	8	X		PI
Teucrium canadense	Woodsage						X	6	X		PI
Veronica peregrina	Purslane Speedwell						X	7			
Vaccinium corymbosum	Highbush Blueberry						X	9			
Zannichellia palustris	Horned Pondweed				X	X		1	X		PI

* Status based on "The Vascular Plant Flora of the Regional Municipality of Hamilton Wentworth, Ontario" Goodban (1995).

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APPENDIX 3: POTENTIALLY IMPACTED SIGNIFICANT WILDLIFE SPECIES OF THE RED HILL CREEK VALLEY

Species	Status					Potentially Impacted	Impact Type[6]
	BIRHV[1]	HWNAI[2]	NHIC[3]	OMNR[4]	OBAR[5]		Habitat
Butterflies & Moths							
Northern Cloudywing	(R)	R	S5			X	X
Hickory Hairstreak	R	R	S3			X	X
Squash Vine Borer Moth		R					
Dogwood Borer Moth		R					
Tosale oviplagalis		R					
Spear-marked Black		R					
Black & yellow Lichen Moth		R					
Herpetofauna							
Jefferson Salamander	LXTP	R	S2				
Pickerel Frog	LXTP	R	S4				
Common Musk Turtle	LXTP	XTP	S4				
Common Map Turtle	LXTP	R	S4				
Blandings Turtle	LXTP	R	S4				
Eartern Spiny Softshell	LXTP	R	S3	THR			
Northern Ribbon Snake	LXTP	R	S4				
Northern Ringneck Snake		R	S4			?	?
Birds							
Least Bittern	R	R	S3	VUL	THR	X	X
Northern Harrier	BU	R	S4B, SZN				
Cooper's Hawk	BRC	R	S3S4B, SZN	VUL	VUL	X	X
Black Tern	XTP	R	S3?	VUL	THR		
Carolina Wren	BR	R	(S3S4)			X	X
Louisiana Waterthrush	BU	R	S3	VUL	THR		
Yellow-breasted Chat	BU	R	S2S3	VUL	VUL		
Orchard Oriole	BRC	R	S3B, SZN		VUL		
Mammals							
Southern Flying Squirrel	BUK	R-UC	S3	VUL			

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[1] Biological Inventory of Red Hill Valley (Hamilton Naturalists' Club, 1996) and Dougan & Associates (1998) including Van Wagner's Ponds & Marshes

[2] Hamilton-Wentworth Natural Areas Inventory (Heagy, 1995).

[3] Subnational rank (Provincial) assigned by Natural Heritage Information Centre

[4] Ontario Ministry of Natural Resources (OMNR 1996; Riley, 1997)

[5] Recommended Status of *Ontario Birds at Risk* (Austen *et al.*, 1994).

[6] Impact Type – Habitat impacts include the complete or partial removal of habitats that may cause the displacement of significant species; Linkage impacts include the severance of existing linkage corridors utilized by significant species.

ABBREVIATIONS: **R**=Regionally Rare; **UNC**=Regionally Uncommon; **(R)** Locally Rare; **XTP** = Extirpated; **LXTP** = Likely Extirpated; **BU** = Unlikely Breeder; **BRC** = Recent Breeder; **BUK** = Breeding Status Unknown; **S2**= Rare; **S3** = Rare to Uncommon; **S4** = Uncommon; **S5** = Very Common; **VUL** = Vulnerable; **THR** = Threatened

APPENDIX 4: TREE REMOVAL ESTIMATES

Dr. J. Minor published an opinion article in the Hamilton Spectator on April 25, 1997, which presented the findings of a high school student project which concluded that 47,000 trees would be removed by the Expressway.

After reviewing the article we advised the Region that tree counting would not be a productive use of our time given the intensity of tasks already underway, which in that period included documentation of plant communities and restoration opportunities throughout the Watershed.

The reasons for not considering individual trees as a measure in the Impact Assessment are as follows:

1. More universal indicators, such as the areas of vegetation communities and habitats, were already available in the GIS resource database developed as part of the Watershed Study. Areas of plant communities have consistently proven themselves as reliable measures of habitat for impact assessments on the scale of the Red Hill Expressway because they reflect vegetative diversity, forest canopy conditions, and specific wildlife habitat.

2. Tree counts are relevant for detailed study of the history, structure and forest productivity of particular habitats; however, such research was not the focus of the impact assessment. This type of research requires careful study design, particularly to ensure that the sample plots are placed in representative habitat conditions.

3. Trees represent a single, albeit very important component of the valley ecosystem. There are important non-treed habitat areas that will be affected by the Expressway, including marshes, meadows, shrub thickets and shallow soil areas. Indeed, at least 50 of 93 significant species known in the valley, are characteristic of these open communities.

4. The number of trees to be removed does not in itself reveal the functional implications of their loss from the valley, except when examined in the context of particular communities containing rare or otherwise significant trees. Generically speaking, trees can be replaced. However, old growth trees, or regionally rare tree species such as sycamore, are not so easily replaced. Other tree species, such as Norway maple and Manitoba maple are invasive, problematic to slope stability and have the potential to lower biodiversity present in certain parts of the valley.

5. Humans place value on trees as cultural symbols, and they have definite benefits for air quality, noise, and visual aesthetics. However, our assessment was focused on the natural environment, and not the cultural or aesthetic environments.

APPENDIX 4: TREE REMOVAL ESTIMATES

In the spring of 1998, Region staff requested that we conduct a tree count in order to corroborate Dr. Minor's estimate in order to provide an informed reply to concerned members of the Public regarding the outcome of Dr. Minor's study. We obtained a copy of Dr. Minor's report, and after a careful review of its stated methodology, designed our own sampling system which we felt would give us a representative estimate of trees potentially lost. This involved sampling understorey and overstorey tree densities in wooded areas at several locations throughout the Expressway corridor and then projecting overall losses by calculating the total amount of wooded habitat to be removed from the valley.

Detailed methodology for the estimate is outlined as follows:

1. A total of six (6) sites were selected for sampling between Mud Street and Brampton Street. Selected sites were representative of various woodland/forest communities known to occur in the area to be cleared. Forest community types included Escarpment forest, valley slope forest, mature floodplain forest, immature floodplain forest and early successional floodplain forest.
2. Quantitative sampling of tree densities at these six sites was conducted on March 24th, 1998.
3. The size of each sample plot was 400 m^2, configuration was circular using an 11.28 m radius
4. All trees within the sampling plot area were enumerated and classified as either understorey or overstorey. Understorey trees included saplings and young trees between 5 and 15 cm in diameter. Overstorey trees included those with diameters greater than 15 cm.
5. Stem density values for understorey and overstorey trees were converted to number of trees per hectare for each plot (i.e., # of tress / 400 m^2 x 25 = # of trees / 1.0 ha).
6. Stem densities for understorey and overstorey trees were averaged for the six plots.
7. GIS was used to estimate the amount of wooded habitat to be cleared in hectares
8. Average stem density for understorey and overstorey trees were multiplied by the estimate of the amount of wooded habitat to be cleared.

The results of our assessment are presented in the Table below.

The estimated number of trees to be removed by the Project is 41,471 according to our assessment. It should be noted that this value is only an estimate and that the actual figure could be higher or lower. Discrepancies between this figure and the 47,000 trees estimated in Dr. J. Minor's study may be attributed to the selection of sampling sites and different sampling methodologies. What is common to both estimates is the fact that seedlings and small saplings have been excluded from the density calculations. If these life stages were to be included, both estimates would certainly be higher.

APPENDIX 4: TREE REMOVAL ESTIMATES

Plot No.	Vegetation Community Type	Location	Overstorey Trees (>15 cm Ø) per 400 m^2 plot	Understorey Trees (5-15 cm Ø) # per 400 m^2 plot	Total
1	Niagara Escarpment Forest	Mt. Albion Rd.	30	26	56
2	Valley Slope Forest	E. Bagshaw School	13	24	37
3	Mature Floodplain Forest	Greenhill Ave. - TH&B	10	33	43
4	Immature Floodplain Forest	Greenhill Ave. - TH&B	10	22	32
5	Successional Floodplain Forest	TH&B	10	55	65
6	Immature Floodplain Forest	N of Queenston Rd.	18	20	38
		Mean # of trees / plot	15.2	30	45.2
		Mean # of trees / hectare	380	750	1130
		Area of Woodland/Forest in IADP Direct Impact Zone	36.7 ha	36.7 ha	36.7 ha
		Estimate of # of trees within IADP Direct Impact Zone	13,946	27,525	41,471

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